



RECEIVED

DEC 27 2002

TECHNOLOGY CENTER R3700

Revised Claims

1. A comprehensive gas processor for removing the moisture and recovering the higher hydrocarbons (i.e., C_2^+) therein either on-situ in a gas field or in a plant comprising:
- (a) an integrated gas processor comprising two sections working on a hybrid process, i.e., an integration of two different processes within a single casing:
- a) i) a refrigeration-dehydration section working on refrigeration process wherein the inlet gas contacts with a counter-flowing stream of dispersed cold heat-transport medium containing a non- or low-volatile hydrate inhibitor with boiling point higher than 180°C and the moisture of said gas is condensed and removed with the cold heat-transport medium; and
- ii) an absorption section working on low-temperature absorption process wherein the dehydrated gas contacts with a counter-flowing stream of dispersed liquid absorbent with a hydrocarbon gas solubility higher than 20 scf/gal wherein the higher hydrocarbons (i.e., C_2^+) are absorbed;
- (b) a heat-transport medium cooler comprising a pre-cooling stage and a deep-cooling stage wherein in said pre-cooling stage said heat-transport medium is pre-cooled with the cold outlet gas left said integrated gas processor and in said deep-cooling stage the medium is deep-cooled with the refrigerant provided with a refrigerator;
- (c) an absorbent cooler comprising a pre-cooling stage and a deep-cooling stage wherein in said pre-cooling stage said recycling absorbent is pre-cooled with the cold outlet absorbent left said integrated gas processor and in said deep-cooling stage the absorbent is deep-cooled with the refrigerant provided with a refrigerator;
- (d) a fractional distiller for separating the absorbed higher hydrocarbons as a product from the outlet absorbent left said integrated gas processor and then the separated absorbent is recycled back to said integrated gas processor;
- (e) an inhibitor regenerator for concentrating the low-volatile hydrate inhibitor to be recycled and discharging the wastewater;
- (f) a refrigerator for providing the refrigerant to said deep-cooling stages of said heat-transport

a1

medium cooler and said absorbent cooler;

(g) a pipeline for delivering the recovered higher hydrocarbons; and

(h) a gas inlet pipeline and a pipeline for delivering the processed gas.

2. A comprehensive gas processor of claim 1 wherein the dehydration section of said integrated processor and its accessories (comprising said heat-transport medium cooler, said inhibitor regenerator, said refrigerator, and said gas inlet pipeline and a pipeline for delivering the processed gas) are operated independently as a gas dehydrator without incorporating the absorption section.
3. A comprehensive gas processor of claim 1 wherein said heat-transport medium is an aqueous solution of calcium chloride or other ionizing salts and the regeneration rate of said solution is less than 5 liter per kg of wastewater to be discharged.
4. A comprehensive gas processor of claim 1 wherein said heat-transport medium is an aqueous solution of ethylene glycol or other organic compounds with boiling points higher than 180°C and the regeneration rate of said solution is less than 5 liter per kg of wastewater discharged.
5. A comprehensive gas processor of claim 1 wherein said absorbent is heavy oil (i.e., hydrocarbon mixture with molecular weight higher than 100) or other organic compounds with hydrocarbon gas solubility higher than 20scf/gal liquid.
6. A comprehensive gas processor of claim 1 when working on inlet gas pressure greater than 5.0 MPa wherein said refrigerant to said deep-cooling stages of said heat-transport medium cooler and said absorbent cooler is provided with a gas expansion device when the inlet gas pressure is greater than 5.0 MPa.

7th

A gas expansion device of claim 6 wherein said expansion device is a triple-sectional free-piston gas expander-compressor-booster comprising:

(a) a gas expansion cylinder and a gas compression cylinder;

(b) a co-shaft gas expansion piston and gas compression piston; and

(c) a co-shaft gas-fueled booster piston-engine providing supplemental power for compressing said expanded gas to the required delivery pipeline pressure.

a2